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Definition of the *Bradysia luctifica* group (Diptera, Sciaridae), with the description of five new species

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Abstract

The *Bradysia luctifica* group is characterized for a number of species with an Oriental-Australasian distribution. The group includes the following species: *Bradysia abrupta* sp. n. (Malaysia: Pahang, Selangor), *B. calicula* sp. n. (Malaysia: Sabah), *B. conflexa* sp. n. (Malaysia: Pahang), *B. fornicata* sp. n. (Malaysia: Pahang), *B. luctifica* (Skuse, 1888) (Australia: South Australia, Indonesia: Ceram, New Caledonia, Papua New Guinea), *B. robusta* Mohrig, 2015 (Papua New Guinea) and *B. torosa* sp. n. (Papua New Guinea: Bismarck Archipelago). The species are keyed and the new species are described and illustrated.

Key words: Sciaroidea, new taxa, Oriental, Australasian

Introduction

Vilkamaa, Hippa & Mohrig (2012) described *Bradysia planistylata* from New Caledonia. Mohrig (2015) recorded this species in Papua New Guinea and described a highly similar one, *Bradysia robusta* Mohrig 2015, from the same locality. When revising the sciarid species described by Skuse (1888), Broadley *et al.* (2016) synonymized *B. planistylata* with *B. luctifica* (Skuse, 1888). Vilkamaa *et al.* (2012) classified *B. planistylata* in the *Bradysia nervosa* group *sensu* Menzel & Mohrig (2000) whereas Mohrig (2015) placed both species in the *B. hilaris* group. In the light of the new material, it is evident that the species concerned belong to neither of these groups but that a new species group should be recognized. This is done here along the description of five new species found in the Oriental and Australasian regions.

Material and methods

The specimens studied were picked out from unidentified museum materials of Sciaridae collected with Malaise traps and stored in 70 % ethanol. The specimens were mounted on microscope slides in Euparal, after dehydrating them in absolute ethanol. The material from Noona Dan Expedition was mounted in Hoyer's medium when received for study. These preparations were deteriorated and the specimens were remounted in Euparal, after treating them successively with KOH, distilled water, 80% ethanol and absolute ethanol. The terminology and methods of measuring and illustrating structures with drawings follow Hippa & Vilkamaa (1991; 1994) and Hippa *et al.* (2010). The photographs of the slide-mounted specimens were taken using a Leica MC170 HD camera mounted on a Leica DM 4000 B LED research microscope. The material is deposited in the following collections: Zoological Museum, Finnish Museum of Natural History, Helsinki, Finland (MZB), The Natural History Museum, London, UK (BMNH), National Museum of Wales, Cardiff, UK (NMWC), Swedish Museum of Natural History, Stockholm, Sweden (SMNH) and Zoological Museum, University of Copenhagen, Denmark (ZMUC).

Characters of the *Bradysia luctifica* group

Small to middle-sized *Bradysia*, wing length 2.1–3.0 mm.

Head. Face and antenna concolorous brown. Eye bridge 2–4 facets wide. Antenna short, surface of flagellomeres smooth, setosity short and dense (exceptions), necks shorter than wide, whitish, apically slightly brownish. Face with numerous short and fine setae, clypeus with 1–12 setae. Maxillary palpus with 3 segments, 1st segment large, 2nd and 3rd segments much smaller or all segments long, 3rd longest; 1st segment with distinct, well-demarcated patch of sensilla and with 4–12 setae, 2nd segment with two sharp setae. **Thorax.** Brown. Scutum with dark and fine setosity, scutellum with 4 long setae or some setae slightly longer. **Wing.** Fumose, broad, with distinct anal lobe and veins. R1 short, ending far before fork of M. c long, c/w 0.6–0.9. R5 with only dorsal setae. **Legs.** Fore tibia ventrally with some spinose setae, with moderate tibial comb. Tarsal claws without teeth. **Abdomen.** Brown, setosity rather dark, long and strong. **Hypopygium.** Brown, concolorous with abdomen. Intergonocoxal area without lobe, membranous part setose. Some species with intergonocoxal area basally with medial sclerotized stripe. Gonocoxae broad, basally united (U-shaped), margin between sclerotized and membranous parts of gonocoxa distinct, apodemes of gonocoxa long and narrow. Gonostylus long and narrow, apically blunt or transversely cut, dorsally excavated, subapically with dorsal group of short, strong and straight megasetae and some elongated setae, apically with strong, blunt and dense setosity, without apical tooth. Tegmen with long basal apodemes, with sclerotized medial structures, with large distinct area of strong aedeagal teeth, some species with area of apical teeth and with apicodorsal hyaline process (lacking in *B. torosa*). Aedeagal apodeme short to long.

Discussion. *Bradysia luctifica* group is similar to both *B. hilaris* and *B. nervosa* groups *sensu* Menzel & Mohrig (2000) in having a large area of aedeagal teeth in the tegmen, long basal apodemes of tegmen (especially in *B. hilaris* and *B. luctifica* groups) and in having short wing vein R1. *Bradysia luctifica* group is similar to *B. nervosa* group and differs from *B. hilaris* group in having the gonocoxae united (U-shaped) and in having their medial margin very distinct. (Also *Bradysia browni* (Shaw, 1935) of the *B. nervosa* group has its gonostylus strongly impressed). The group has also its gonostylus strongly flat. It is similar to *B. hilaris* group, and differs from *B. nervosa* group in having the megasetae short and thick, spine-like. *Bradysia luctifica* group differs from both of these other groups in having short antennal flagellomeres and a large 1st segment of the maxillary palpus (both with exceptions), in having the membranous area of the hypopygium setose, the gonostylus strongly hollowed dorsally, gonostylar megasetae in a dorsal position, the apical setae of the gonostylus blunt, the tegmen with apicominal sclerotizations and with an apicodorsal hyaline process. Even if all species of *B. luctifica* group do not share all these characters, all of them share most of them and we regard them closely related.

Key to species of the *Bradysia luctifica* group

- | | | |
|---|---|-----------------------------|
| 1 | Gonostylus with large dorsal lobe with megasetae | <i>B. robusta</i> Mohrig |
| - | Gonostylus without large lobe | 2 |
| 2 | Colour dark brown, tegmen without hyaline apicodorsal part, hypopygium basally with sclerotized medial stripe | <i>B. torosa</i> sp. n. |
| - | Colour not especially dark brown, tegmen with hyaline apicodorsal part, hypopygium basally without sclerotized medial stripe | 3 |
| 3 | Maxillary palpus normal, with narrow, rather long segments | 4 |
| - | Maxillary palpus with large 1 st segment and small 2 nd and 3 rd segments | 5 |
| 4 | Gonostylus very strongly narrowed towards apex, at its widest about 3x as wide as at its narrowest, tegmen with membranous lateral curvature, short apicodorsal hyaline process and broad, nearly straight, nearly perpendicular basal apodemes | <i>B. calicula</i> sp. n. |
| - | Gonostylus less strongly narrowed towards apex, at its widest about 2x as wide as at its narrowest, tegmen without membranous lateral curvature, with large apicodorsal hyaline process and narrow, curved, oblique basal apodemes | <i>B. luctifica</i> (Skuse) |
| 5 | Gonostylus slightly curved, tegmen with small apicodorsal hyaline process, setae of basal antennal flagellomeres longer than width of flagellomeres | <i>B. fornicate</i> sp. n. |
| - | Gonostylus strongly curved, tegmen with large apicodorsal hyaline process, setae of basal antennal flagellomeres shorter than width of flagellomeres | 6 |
| 6 | Gonostylus evenly narrow, with small apical lobe with megasetae, tegmen straight laterally | <i>B. abrupta</i> sp. n. |
| - | Gonostylus widened towards apex, without apical lobe, megasetae in a subapical dorsal row, tegmen curved laterally | <i>B. conflexa</i> sp. n. |

Descriptions of the new species

Bradysia abrupta sp. n.

Figs 1 A, D, 2, 3

Material studied. Holotype male. MALAYSIA, Pahang, Cameron Highlands, Tanah Rata, Gunung Jasar, 1400 m, Malaise trap, 20–26.II.1995, A. Heinakroon (in SMNH). Paratypes. Same data as holotype, 1 male (in MZH); MALAYSIA, Selangor, Genting Highlands, Gunung Ulu Kali, 5650 ft, forest edge, Malaise trap, 12–22.III.1997, H. Hippa, M. Jaschhof & B. Viklund, 9 males (4 in MZH, 5 in SMNH).

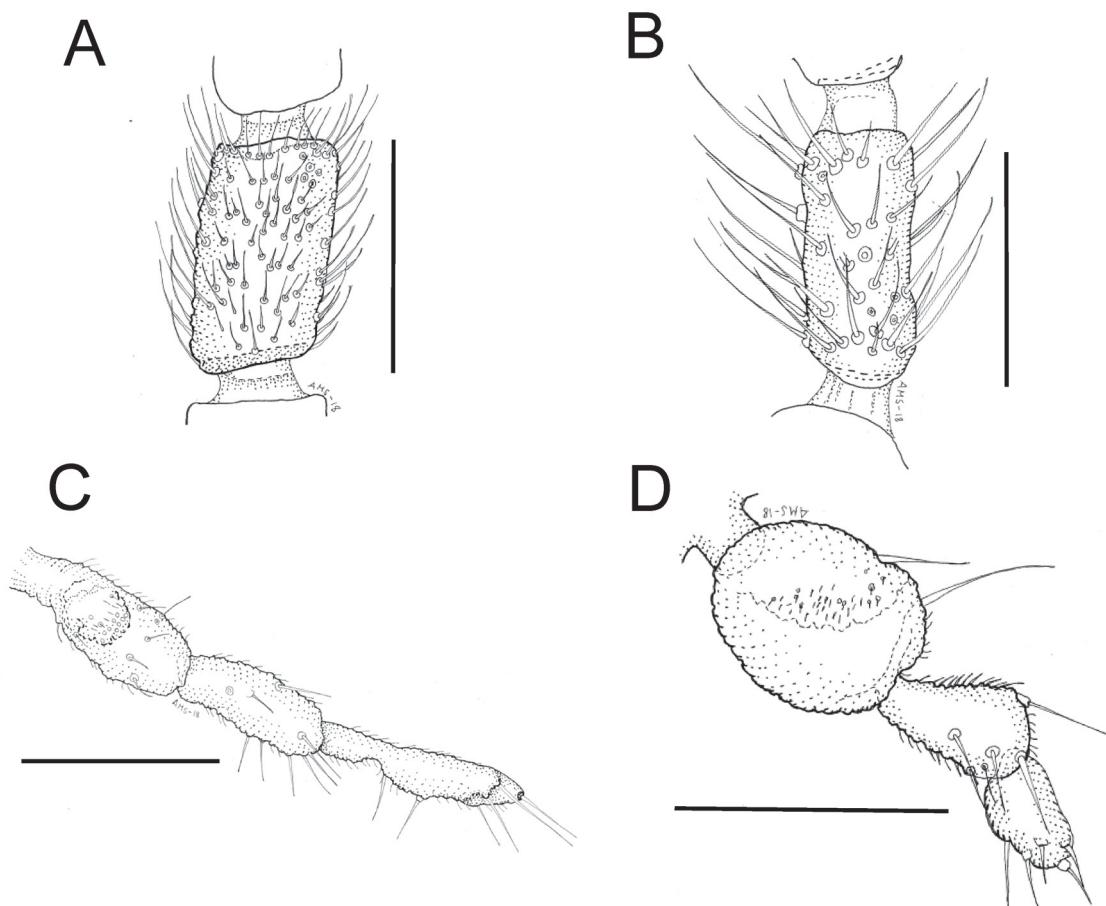


FIGURE 1. A, B. 4th antennal flagellomere, frontal. C, D. Maxillary palpus, dorsolateral. A, D: *Bradysia abrupta* sp. n. (paratypes). B: *B. fornicata* sp. n. (holotype). C: *B. luctifica* (Skuse, 1888) (from Ceram). Scale 0.10 mm.

Description. Male. **Head.** Face and antenna concolorous pale brown, maxillary palpus very pale brown. Eye bridge 2–3 facets wide. Face with 25–38 short and fine setae. Clypeus with 1–3 setae or rarely non-setose. Maxillary palpus with 3 segments; 1st segment large, much longer and wider than other segments, 2nd and 3rd segments equally long (Fig. 1 D); 1st segment with 5–9 setae, with well-demarcated, large dorsal patch of sensilla; surface of antennal flagellomeres smooth, densely setose, body of 4th flagellomere 1.4–1.6x as long as wide, the neck shorter than wide, the longest setae shorter than the width of flagellomere (Fig. 1 A). **Thorax.** Brown, setae dark. Anterior pronotum with 2–6 setae. Proepisternum with 5–11 setae. Scutellum with 4 longer and some short setae. **Wing.** Fumose. Length 2.3–2.6 mm. Width/length 0.50. Anal lobe large. Veins distinct. stM equally long as fork of M. R1/R 0.7–0.8. c/w 0.6–0.8. r-m and bM nearly equal in length. bM non-setose, r-m non-setose, rarely with 1 seta. Halter yellow. **Legs.** Fore coxa yellow or pale brown, middle and hind coxa pale brown. Coxal setae dark. Tibiae and tarsi yellow. Fore tibial organ with pale vestiture forming a row. Fore tibial spur longer than the

tibial width. Claws without teeth. **Abdomen.** Pale brown, setae dark, rather strong and long. **Hypopygium** (Figs 2, 3). Brown, concolorous with abdomen. Intergonocoxal area rather short. Gonocoxae broad, basally united (U-shaped), longer than gonostylus, with long setosity, medial margin richly setose, membranous part with short setae, without microtrichia. Gonostylus evenly narrow, strongly curved, apex transversely cut, richly setose, apex with numerous blunt setae and with a small dorsal lobe with some short and thick megasetae, without apical tooth. Tegmen conical, with medial sclerotized structures, apicoventrally with numerous small teeth, dorsally with large hyalinous apical part, with long strongly sclerotized basal apodemes, with a large area of strong aedeagal teeth. Aedeagal apodeme short.

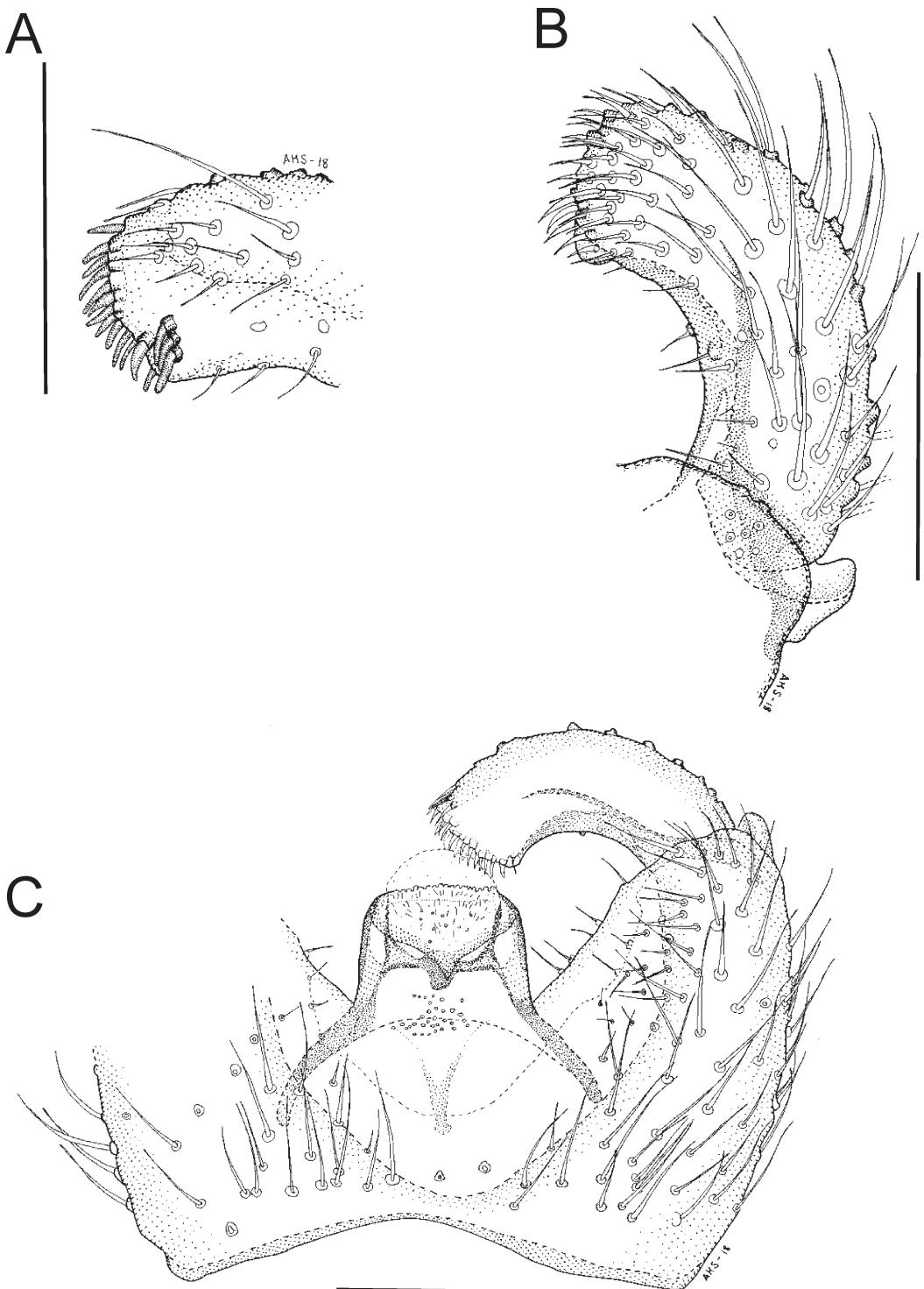


FIGURE 2. *Bradysia abrupta* sp. n. (A paratype, B, C holotype). **A.** Apical part of gonostylus, dorsal. **B.** Gonostylus, ventral. **C.** Part of hypopygium, ventral. Scale 0.10 mm.

A



B



FIGURE 3. *Bradysia abrupta* sp. n. (A holotype, B paratype). **A.** Hypopygium, ventral. **B.** Hypopygium, dorsal. Scale 0.10 mm.

Discussion. *Bradysia abrupta* sp. n. is similar to *B. conflexa* sp. n. and *B. luctifica* and *B. calicula* sp. n. in having a broad apicodorsal hyalinous process in its tegmen. *Bradysia abrupta* and *B. conflexa* are similar in having their gonostylus evenly broad or slightly widened towards apex, whereas *B. luctifica* and *B. calicula* have their gonostylus narrowed towards apex. *Bradysia abrupta* can be distinguished from *B. conflexa* by having its tegmen laterally straight and its gonostylus evenly narrow, whereas *B. conflexa* has its tegmen laterally curved and the gonostylus widened towards apex. For discussion of *B. luctifica* and *B. calicula*, see under the latter.

Etymology. The name is Latin, *abrupta*, abrupt, referring to the transversely cut apex of the gonostylus.

Bradysia calicula sp. n.

Fig. 4

Material studied. Holotype male. MALAYSIA, Sabah, Danum Valley, 5°01'N, 117°47'E, lowland mixed dipterocarp forest, Malaise trap, 24.IX–12.X.1987, A.H. Kirk-Spriggs (NMW Sabah (Borneo) Expedition, NMW.Z.1987.094) (in NMWC).

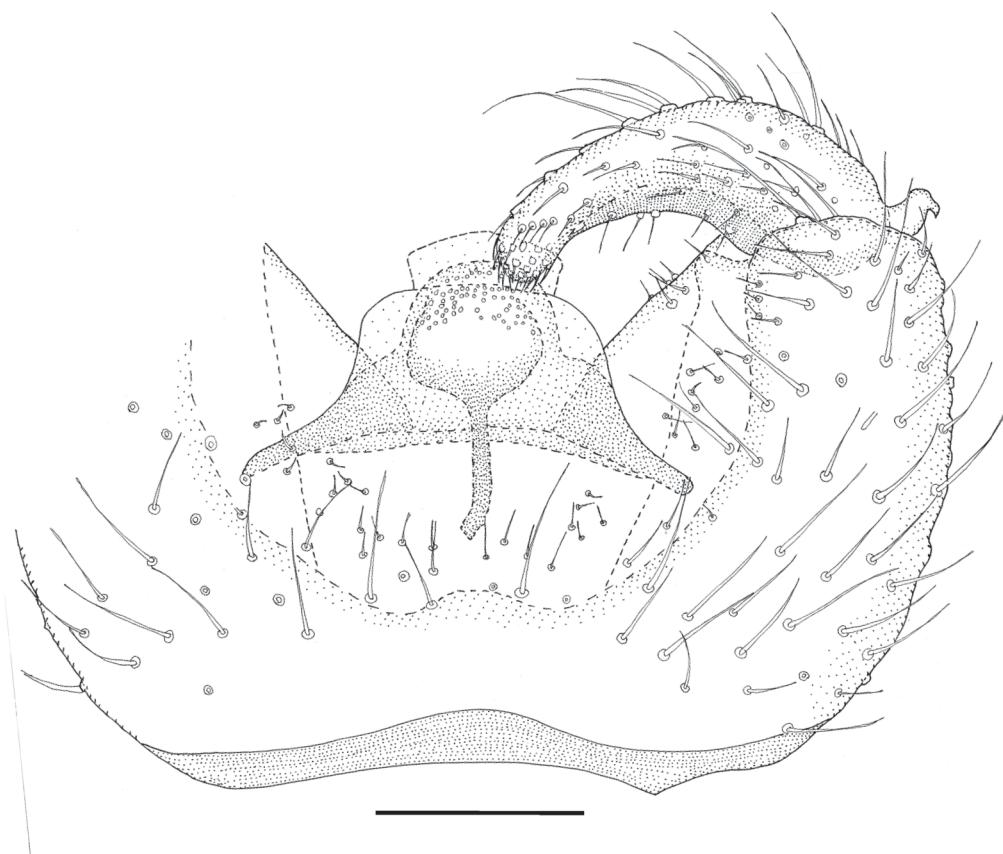


FIGURE 4. *Bradysia calicula* sp. n. (holotype). Part of hypopygium, ventral. Scale 0.10 mm.

Description. Male. **Head.** Face and antenna concolorous pale brown, maxillary palpus pale brown. Eye bridge 2–3 facets wide. Face with 6 short and fine setae. Clypeus with 2 setae. Maxillary palpus with 3 segments; 1st segment normal, longer than 3rd segment, 2nd segment shortest; 1st segment with 6/7 setae, with indistinctly demarcated dorsal patch of sensilla; surface of antennal flagellomeres smooth, densely setose, body of 4th flagellomere 1.95x as long as wide, the neck shorter than wide, the longest setae shorter than the width of flagellomere. **Thorax.** Brown, setae dark. Anterior pronotum with 5 setae. Proepisternum with 2 setae. Setae of scutellum not well detectable in the specimen studied. **Wing.** Fumose. Length 2.1 mm. Width/length 0.40. Anal lobe moderate. Veins distinct. stM equally long as fork of M. R1/R 0.65. c/w 0.85. r-m and bM nearly equal in length, both non-setose. Halter yellow, short. **Legs.** Coxae brown, as thorax. Coxal setae dark. Tibiae and tarsi pale brown. Fore tibiae missing in the specimen studied. Claws without teeth. **Abdomen.** Brown, slightly paler than

thorax, setae dark, rather fine and long. **Hypopygium** (Fig. 4). Brown, concolorous with abdomen. Intergonocoxal area moderate. Gonocoxae broad, laterally roundish, basally united (U-shaped), much longer than gonostylus, with long setosity, medial margin distinct, slightly sclerotized, sparsely setose, membranous part with short setae, with areas of microtrichia. Gonostylus strongly narrowed towards apex, strongly curved, richly setose, apex with numerous spine-like setae, with some strong ventral spine-like setae, without apical tooth. Tegmen laterally with membranous curvature, with strong medial sclerotized structures, dorsally with short hyalinous apical part, with strongly sclerotized, nearly perpendicular basal apodemes, with a large area of strong aedeagal teeth. Aedeagal apodeme moderate.

Discussion. *Bradysia calicula* sp. n. is most similar to *B. luctifica* in having a rather similar gonostylus and a long maxillary palpus but differs in having its tegmen more strongly narrowed towards apex, broader gonocoxae with more roundish medial margins and the tegmen with membranous lateral curvature, stronger sclerotizations and a shorter hyalinous apical process.

Etymology. The name is Latin, *calicula*, cup, referring to the cup-shaped hypopygium of the species.

***Bradysia conflexa* sp. n.**

Fig. 5

Material studied. Holotype male. MALAYSIA, Pahang, Genting Highlands, Awana Cable Car Route, Malaise trap, 10–22.III.1997, H. Hippa, M. Jaschhof & B. Viklund (in SMNH).

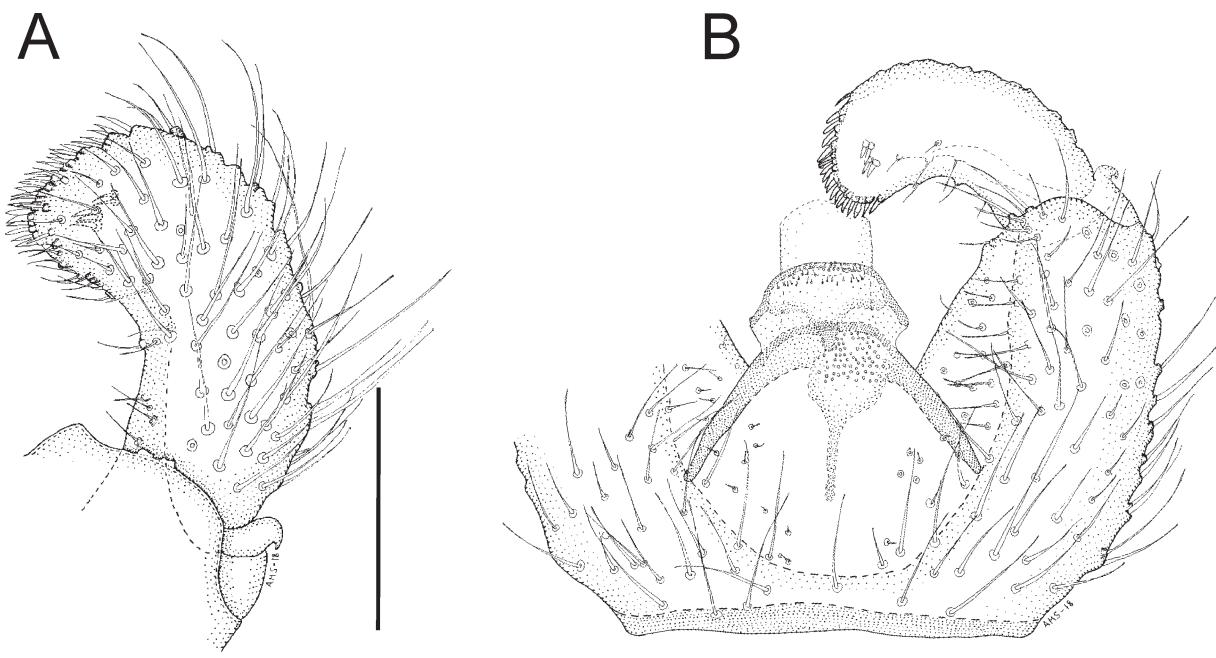


FIGURE 5. *Bradysia conflexa* sp. n. (holotype). **A.** Gonostylus, ventral. **B.** Part of hypopygium, ventral. Scale 0.10 mm.

Description. Male. Head. Face and antenna concolorous pale brown, maxillary palpus very pale brown. Eye bridge 2–3 facets wide. Face with 27 short and fine setae. Clypeus with 2 setae. Maxillary palpus with 3 segments; 1st segment large and much longer than other segments, 2nd segment longer than 3rd segment; 1st segment with 4 setae, with well-demarcated, large dorsal patch of sensilla; surface of antennal flagellomeres smooth, densely setose, body of 4th flagellomere 1.25x as long as wide, the neck shorter than wide, the longest setae shorter than the width of flagellomere. Thorax. Brown, setae dark. Anterior pronotum with 6 setae. Proepisternum with 8 setae. Scutellum with 4 longer and some short setae. Wing. Fumose. Length 2.1 mm. Width/length 0.50. Anal lobe large. Veins distinct. stM equally long as fork of M. R1/R 0.7. c/w 0.9. r-m longer than bM. bM non-setose, r-m with 2 setae. Halter yellow. Legs. Coxae pale brown, setae dark. Tibiae and tarsi yellow. Fore tibial organ with pale vestiture forming a row. Fore tibial spur longer than the tibial width. Claws without teeth. Abdomen. Pale brown,

setae dark, fine and rather long. **Hypopygium** (Fig. 5). Brown, concolorous with abdomen. Intergonocoxal area rather short. Gonocoxae broad, basally united (U-shaped), longer than gonostylus, with long setosity, medial margin richly setose, membranous part with short setae, without microtrichia. Gonostylus narrow, slightly widened towards apex, strongly curved, richly setose, apex with numerous blunt setae, subapically with a row of spine-like megasetae, without apical tooth. Tegmen laterally curved, with medial sclerotized structures, apicoventrally with numerous small teeth, dorsally with long hyaline apical part, with long strongly sclerotized basal apodemes, with a large area of strong aedeagal teeth. Aedeagal apodeme short.

Discussion. See under *Bradysia abrupta*.

Etymology. The name is Latin, *conflexa*, bent, referring to the curved gonostylus of the species.

***Bradysia fornicata* sp. n.**

Figs 1 B, 6

Material studied. Holotype male. MALAYSIA, Pahang, Genting, VII.1981, R.I. Vane-Wright. (in BMNH).

Description. Male. **Head.** Face and antenna concolorous pale brown, maxillary palpus yellow. Eye bridge 1–3 facets wide. Face with 33 short and fine setae. Clypeus with 1 seta. Maxillary palpus with 3 segments; 1st segment large and much longer than other segments, 2nd segment longer than 3rd segment; 1st segment with 6–7 setae, with well-demarcated, large dorsal patch of sensilla; surface of antennal flagellomeres smooth, rather sparsely setose, body of 4th flagellomere 2.2x as long as wide, the neck slightly longer than wide, the longest setae longer than the width of flagellomere (Fig. 1 B). **Thorax.** Brown, setae dark. Anterior pronotum with 6 setae. Proepisternum with 5 setae. Scutellum with short setae. **Wing.** Fumose. Length 2.8 mm. Width/length 0.45. Anal lobe large. Veins distinct. stM equally long as fork of M. R1/R 0.7. c/w 0.85. r-m and bM nearly equal in length. bM non-setose, r-m with 1–2 setae. Halter yellow. **Legs.** Pale brown, setae dark. Fore tibial organ with pale vestiture forming a row. Fore tibial spur longer than the tibial width. Claws without teeth. **Abdomen.** Brown, setae dark rather long and fine. **Hypopygium** (Fig. 6). Brown, concolorous with abdomen. Intergonocoxal area moderate. Gonocoxae narrow, basally united (U-shaped), longer than gonostylus, with long and sparse setosity, medial margin sparsely setose, membranous part with short setae, without microtrichia. Gonostylus narrow, subapically slightly constricted, slightly curved, richly setose, apex roundish, with numerous blunt setae, subapically with a row of spine-like megasetae, without apical tooth. Tegmen laterally slightly curved, with medial sclerotized structures, dorsally with small hyaline apical part, with long, curved, strongly sclerotized basal apodemes, with a large area of strong aedeagal teeth. Aedeagal apodeme long.

Discussion. *Bradysia fornicata* sp. n. differs from all other species of the group in having its tegmen narrow, with a very small hyaline process and with very long basal apodemes, and in having its gonostylus constricted subbasally.

Etymology. The name is Latin, *fornicata*, arched, referring to the strongly arched basal apodemes of the tegmen.

***Bradysia torosa* sp. n.**

Fig. 7

Material studied. Holotype male. PAPUA NEW GUINEA, Bismarck Archipelago, New Britain, Yalom, 4°25' S, 151°45' E, 1000 m, 22.V.1962, Noona Dan Exped. 61-62. (in ZMUC). Paratypes. Same data as holotype, 5 males (3 in ZMUC, 2 in MHZ).

Description. Male. **Head.** Face and antenna concolorous pale brown, maxillary palpus very pale brown. Eye bridge 3–4 facets wide. Face with 50–67 short and fine setae. Clypeus with 8–12 setae. Maxillary palpus with 3 segments; 1st segment as long as 2nd segment, 3rd segment longest; 1st segment with 9–12 setae, with well-demarcated, small dorsal patch of sensilla; surface of antennal flagellomeres smooth, densely setose, body of 4th flagellomere 1.7x as long as wide, the neck shorter than wide, the longest setae shorter than the width of flagellomere. **Thorax.** Dark brown, setae dark and fine. Anterior pronotum with 13–17 setae. Proepisternum with 15–17 setae. Scutellum with 4 slightly longer and some short setae. **Wing.** Fumose. Length 3.0 mm. Width/length 0.50. Anal lobe large. Veins distinct. stM equally long as fork of M. R1/R 0.75–0.80. c/w 0.6–0.7. r-m as long as bM. bM non-setose, r-m non-setose or rarely with 1 seta. Halter yellow and short. **Legs.** Coxae brown, setae dark. Tibiae and tarsi brown. Fore tibial organ with pale vestiture forming a row. Fore tibial spur longer than the tibial width. Claws without teeth. **Abdomen.** Brown, setae dark and rather long and strong. **Hypopygium** (Fig. 7). Dark

brown, concolorous with abdomen. Intergonocoxal area rather long, with some long setae, with sclerotized medial stripe. Gonocoxae narrow, basally united (U-shaped), longer than gonostylus, with long and sparse setosity, medial margin sparsely setose, slightly sclerotized, membranous part with short setae and with microtrichia. Gonostylus narrow, subbasally slightly widened, slightly curved, richly setose, dorsally distinctly excavated, medially with some long setae, apex roundish, with numerous blunt setae, subapically with a dorsal row of spine-like megasetae, without apical tooth. Tegmen conical, laterally sclerotized, with subapical sclerotized structures and apical-subapical hyalinous tooth-like structures, dorsally without hyalinous apical part, with straight, strongly sclerotized basal apodemes, with large area of strong aedeagal teeth. Aedeagal apodeme short.

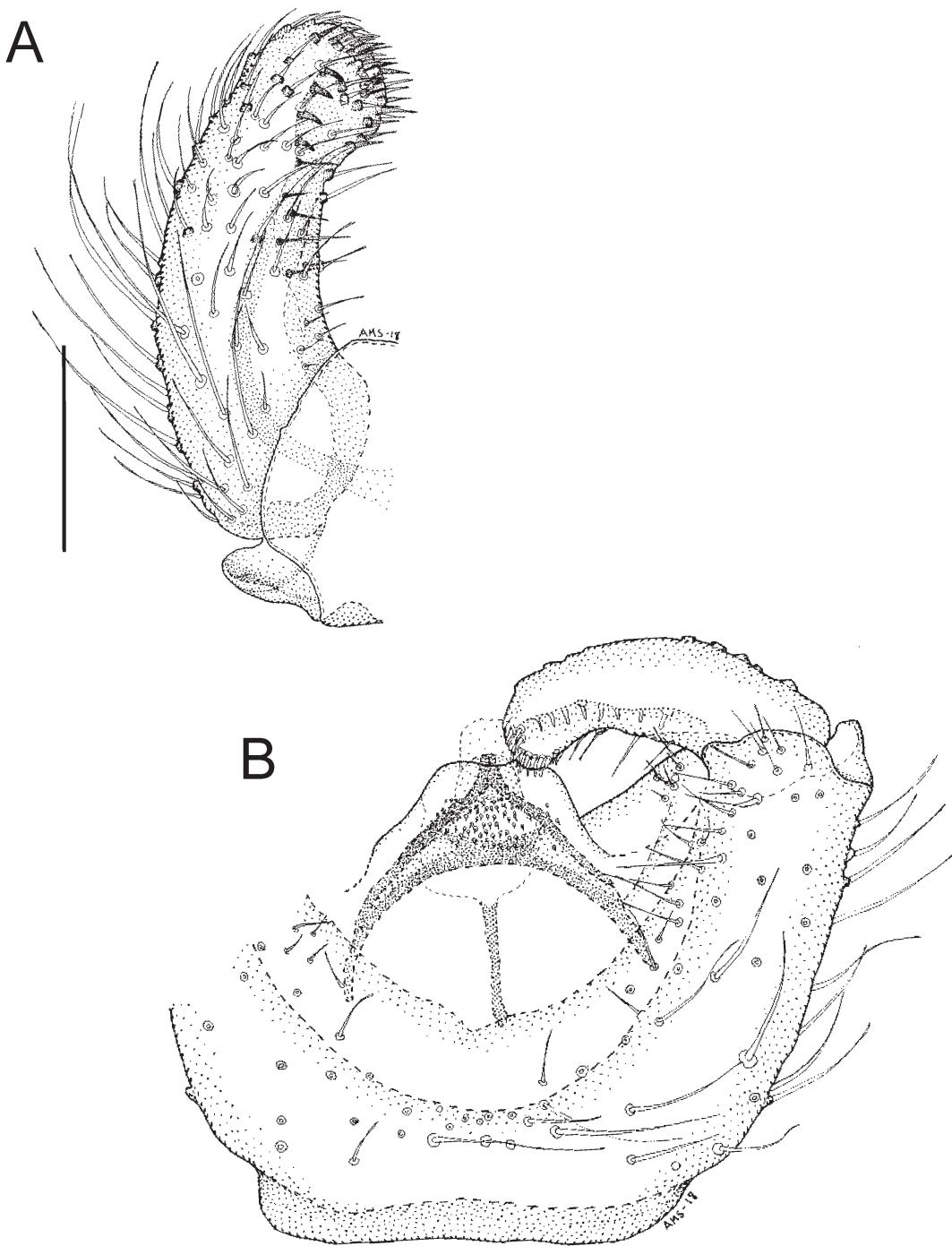


FIGURE 6. *Bradysia fornicata* sp. n. (holotype). **A.** Gonostylus, ventral. **B.** Part of hypopygium, ventral. Scale 0.10 mm.



FIGURE 7. *Bradysia torosa* sp. n. (A paratype, B, C, holotype). **A.** Apical part of gonostylus, dorsal. **B.** Gonostylus, ventral. **C.** Part of hypopygium, ventral. Scale 0.10 mm.

Discussion. *Bradysia torosa* sp. n. differs in some characters from the other species of the group (dark colour, large size, shorter wing vein c) but shares with them the basic structure of the hypopygium, including the dorsally excavated gonostylus, sclerotized medial structures of tegmen, long apodemes of gonocoxa and of tegmen, and we place it tentatively to this group.

Etymology. The name is Latin, *torosa*, muscular, referring to the robust habitus of the species.

Faunistic record

Bradysia luctifica (Skuse, 1888).

INDONESIA, Ceram, Gunung Kobipoto, 500 m, Malaise trap, IX.1987, M.C. Day, 1 male (in BMNH).

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